Space Weather Technical Forecast

Issued on Wednesday, 25 October 2023 at 01:12 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: No significant activity.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity as recorded at GOES16 has been Low with four C-class flares in the past 24hrs, the largest a C4 peaking at 24/2359 UTC from a region of plage rotating over the NE limb. There are currently three sunspot regions on the visible disc, all of which are small and magnetically simple.

No Earth-directed CMEs have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind, as measured by ACE at L1, has been predominantly at Ambient levels, averaging around 350-380 km/s through the period, briefly peaking at 418km/s at 24/2019 UTC. The solar wind density was mostly at below average values, with a late rise to average values from 24/2140 UTC. The Interplanetary Magnetic Field (IMF), Bt, was at weak levels, ranging between 2 and 7nT. The north-south component, Bz, varied weakly between +6 and -3nT. The phi angle was predominantly negative (towards the Sun), with a couple of brief positive periods. The resulting geomagnetic activity was Quiet (Kp0-2).

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux was at background levels. GOES16 high energy (greater than 2MeV) electron flux was at background to moderate levels. The associated 24-hour fluence was well below the Active (1e8 integrated pfu) threshold. The observation at 25/0001UTC was 5.32e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to remain Low or Very Low, with an increasing chance of C-Class flares through the period.

Solar Wind / Geomagnetic Activity: No CMEs currently feature in the forecast. The forecast is for mainly Quiet (Kp0-2) geomagnetic activity. There is a possible coronal hole fast stream arriving from late Day 2, but perhaps more likely Day 3, with a Slight Chance of G1 Minor Storm (Kp5) intervals by the end of the period.

Energetic Particles / Solar Radiation: High energy (greater than 10MeV) proton flux is expected to persist at Background levels. High energy electron flux (greater than 2MeV) is expected to remain at Normal Background levels, with a Slight Chance of a late rise from the coronal hole fast wind.

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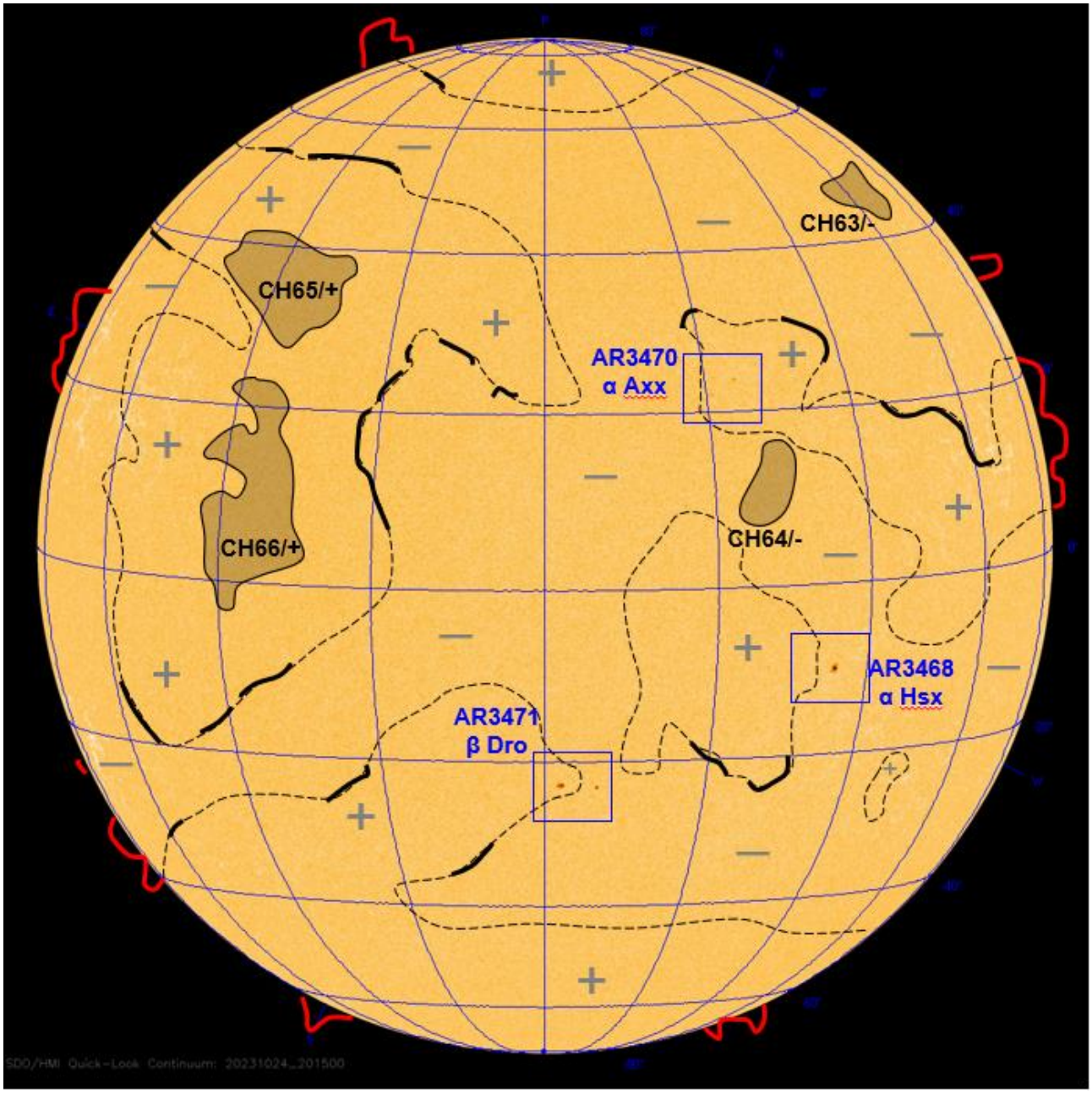
Figure 1. Solar Analysis Valid 24/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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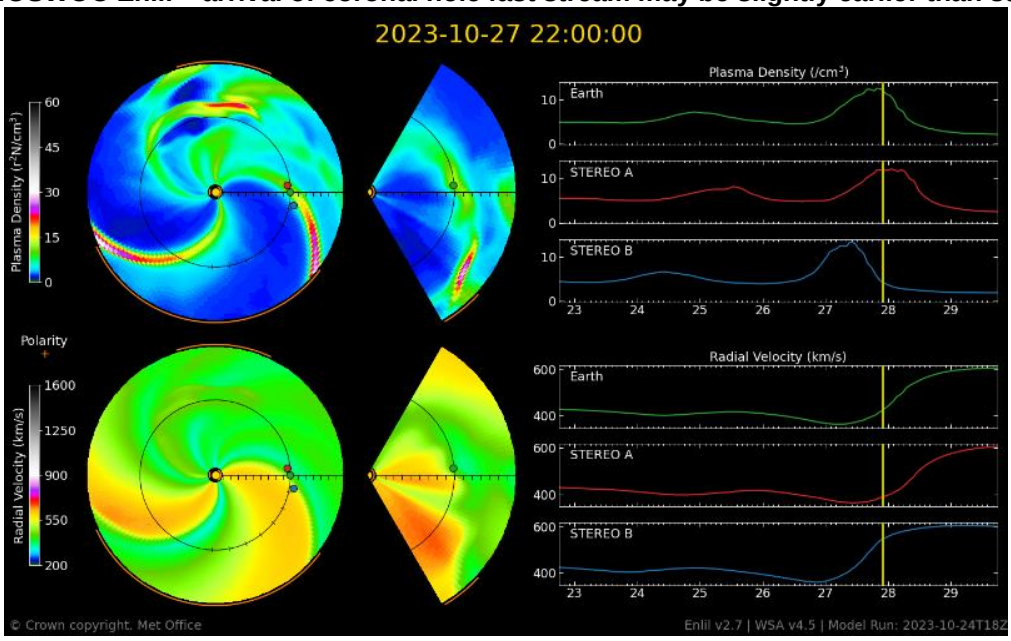
Geomagnetic Storms:
No CMEs currently feature in this four-day period. There are a number of long filaments visible on the Earth-facing side of the Sun which will need to be watched, as any eruptions from these could have impacts at Earth.

Current background solar wind conditions may see potential enhancement from a coronal hole during the forecast period. CH64/- is situated just north of the Suns equator, and may influence Earth during Day 2 (26 Sep), or more likely into Day 3 (27 Sep). This is a weakly negative polarity feature, and isn't expected to give too significant an enhancement. Enlil model output does show a coronal hole high speed stream, albeit with a slightly later arrival time than mentioned above, with the solar winds forecast likely too strong. Enlil perhaps may be picking out the larger coronal holes in the eastern half of the visible disc, which will be coming into play after this forecast period, and as such shouldn't be entirely relied upon.

Geomagnetic activity is likely to be mainly predominantly Quiet (Kp0-2) over the coming period, with a Slight Chance of Unsettled to Active (Kp3-4) intervals increasing from Day 2 onwards due to CH64/-, and a Slight Chance of isolated G1 Minor Storm (Kp5) intervals by Day 4 (27 Sep).

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	1	10	20	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: MOSWOC Enlil – arrival of coronal hole fast stream may be slightly earlier than suggested



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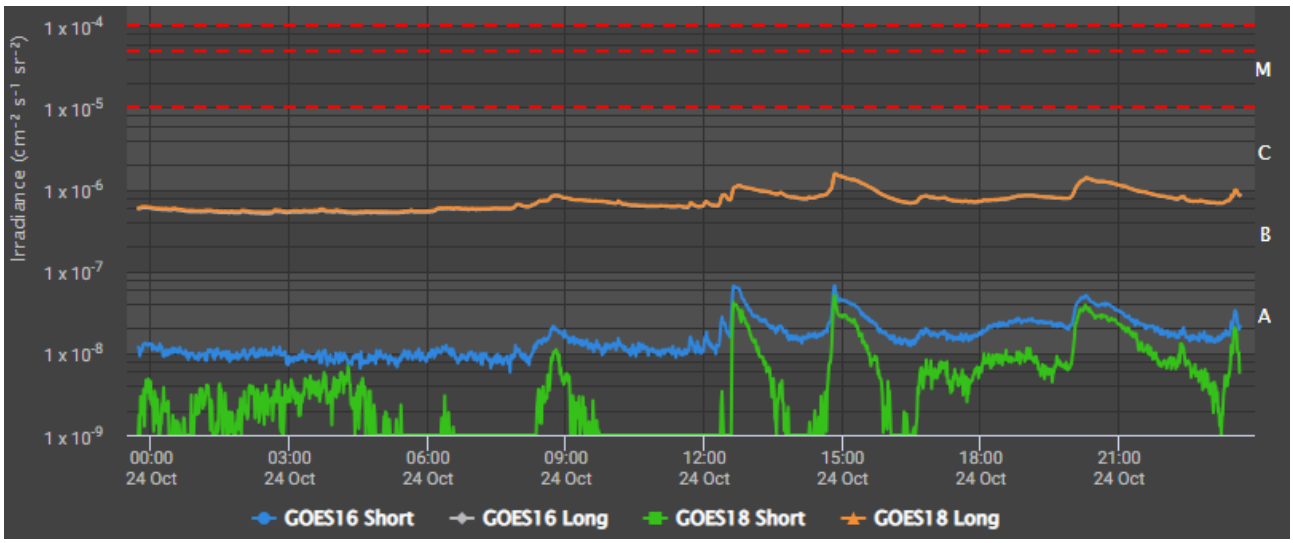
Radio Blackouts - X-Ray Flares:
There are currently just three sunspot regions on the Earth-facing disc, and these are small and simple at the present time, with only AR3468 showing any recent flare activity. Far side sounding data and magnetic looping visible in imagery suggests the potential for active regions to round the eastern limb during the period and these will be monitored for any potential spot development.

Solar activity is expected to remain low but with a slowly increasing Slight Chance of isolated M-class flares forecast.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	5	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES16 & 18 X-ray flux showing three C-flares observed in past 24hrs



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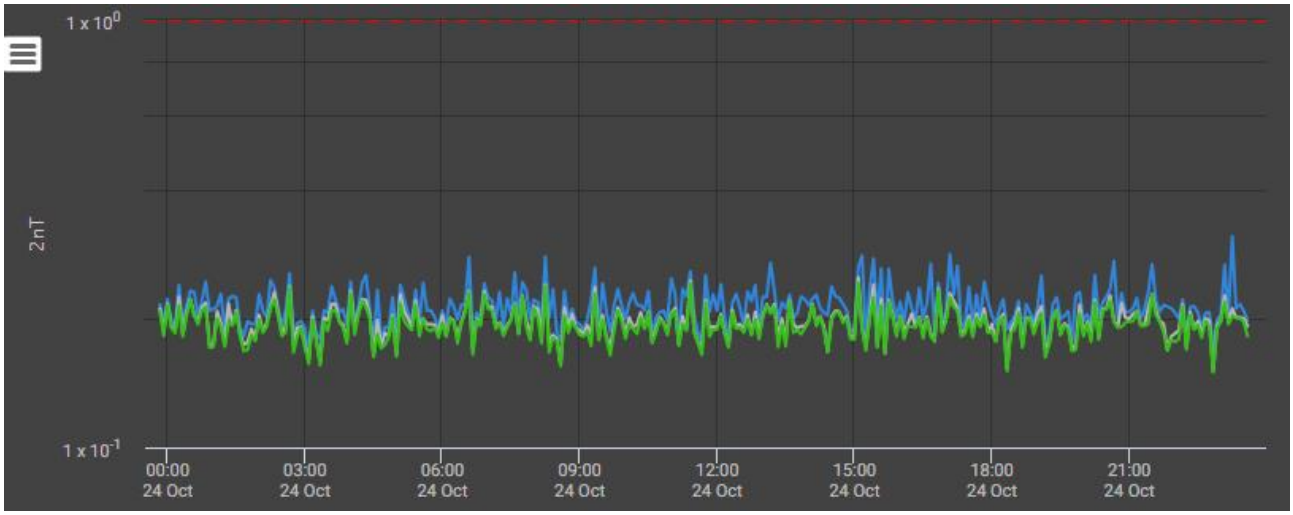
Solar Radiation Storms - (High Energy Protons):
The high energy (greater than 10MeV) proton flux observed by GOES16 is expected to persist at background levels in the absence of significant sunspot regions on the visible disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: GOES16 Proton flux, showing background levels for the past 24hrs



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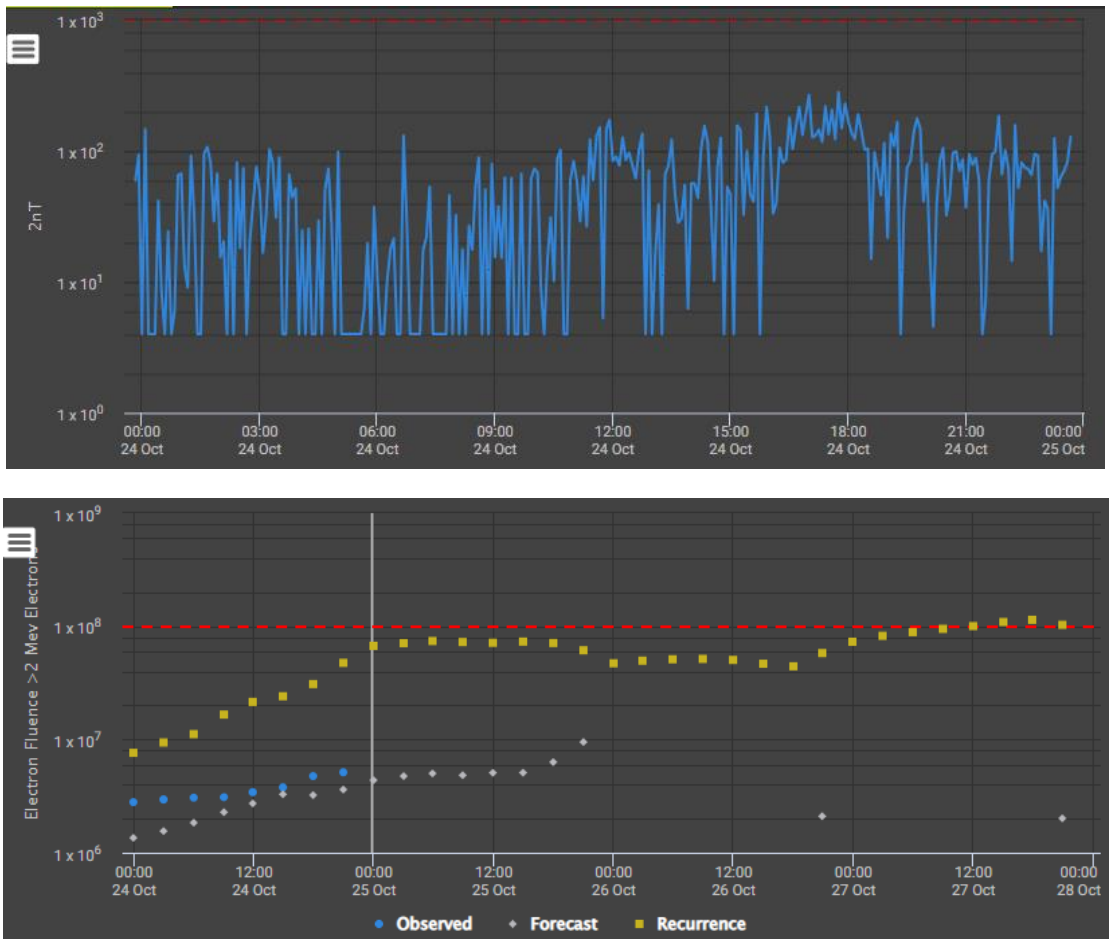
High Energy Electrons Event (≥ 2MeV):
Electron flux observed by GOES16 at GEO is currently at Normal Background levels with a slight diurnal rise to Moderate, and is very likely to remain here given the expected lack of CMEs and modest potency of inbound coronal hole fast winds.

Persistence forecasting for the 24-hour fluence is polluted by CMEs influence on the last rotation, however the latest MOSWOC REFM is almost unmoved from current 24-hour fluence levels across its full 72-hour range. This may be expected to show more of an uptick due to the influence of CH64/- from Day 2 onwards, however even this will probably fall short of Active levels.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	5	10	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: GOES16 Electron flux and Electron fluence



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